FIELD MANUAL
No 101-31-3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., 1 February 1963

NUCLEAR WEAPONS EMPLOYMENT

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* This manual together with FM 101-31-1, 1 February 1963, and FM 101-31-2, 1 February 1963, supersedes FM 101-31, 20 July 1959, including C 1, 29 June 1961; FM 101-31 Modified, 15 September 1960; DA Pam 39-1, 20 May 1959; and DA TC 101-1, 8 December 1958, including C 2, 14 June 1960.

CASUALTY and DAMAGE Tables
Medium-Range Cannon

All figures in meters

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
HOB	Exposed personnel		Protected personnel		Personnel in APC's		Personnel in 1-m earth shelter		Personnel in multistory apt bldgs		Personnel in framehouses		Radius of safety								
													Unwarned, exposed			Warned, exposed			Warned, protected		
	Prompt	Delayed	Prompt	Delayed	Prompt	Delayed	Prompt	Delayed	Prompt	Delayed	Prompt	Delayed	Neg	Mod	Emer	Neg	Mod	Emer	Neg	Mod	Emer
825													1,450	1,125	850	1,450	1,125	850	1,075	850	475
800		0											1,475	1,150	875	1,475	1,150	875	1,100	875	525
775		125										0	1,475	1,150	900	1,475	1,150	900	1,100	900	550
750		225				0						150	1,500	1,175	925	1,500	1,175	925	1,125	925	600
725		300				125				0		250	1,500	1,200	950	1,500	1,200	950	1,150	950	625
700		350				225				100		300	1,525	1,200	950	1,525	1,200	950	1,150	950	650
675		400				300				200		350	1,525	1,225	975	1,525	1,225	975	1,175	975	675
650		450				350				275		400	1,550	1,225	1,000	1,550	1,225	1,000	1,200	1,000	700
625		475				400				325		450	1,550	1,250	1,000	1,550	1,250	1,000	1,200	1,000	725
600		500		0		425				375		475	1,550	1,250	1,025	1,550	1,250	1,025	1,225	1,025	750
575	0	550		125		450				400	0	500	1,575	1,275	1,050	1,575	1,275	1,050	1,225	1,050	775
550	125	550		225	0	500				450	325	525	1,575	1,275	1,050	1,575	1,275	1,050	1,250	1,050	800
525	200	575		275	75	525			0	475	400	550	1,575	1,300	1,075	1,575	1,300	1,075	1,250	1,075	800
500	275	600		300	175	550			75	500	475	575	1,600	1,300	1,075	1,600	1,300	1,075	1,250	1,075	825
475	300	625		350	225	550		0	175	525	550	600	1,600	1,300	1,100	1,600	1,300	1,100	1,275	1,100	825
450	350	650		375	275	575		50	225	550	600	625	1,600	1,325	1,100	1,600	1,325	1,100	1,275	1,100	850
425	375	650	0	400	325	600		150	275	550	700	700	1,625	1,325	1,100	1,625	1,325	1,100	1,300	1,100	850
400	400	675	100	425	350	625		225	300	575	950	950	1,625	1,325	1,125	1,625	1,325	1,125	1,300	1,125	875
375	425	700	175	450	375	625		250	350	600	975	975	1,625	1,350	1,125	1,625	1,350	1,125	1,300	1,125	875
350	450	700	225	475	400	650		300	375	600	1,000	1,000	1,625	1,350	1,125	1,625	1,350	1,125	1,300	1,125	900
325	475	725	250	500	425	650		325	400	625	1,000	1,000	1,650	1,350	1,150	1,650	1,350	1,150	1,325	1,150	900
300	475	725	275	500	425	675	0	350	550	625	975	975	1,650	1,350	1,150	1,650	1,350	1,150	1,325	1,150	900
275	500	725	300	525	450	675	125	375	575	650	950	950	1,650	1,375	1,150	1,650	1,375	1,150	1,325	1,150	925
250	500	750	325	525	475	700	175	375	575	650	925	925	1,650	1,375	1,150	1,650	1,375	1,150	1,325	1,150	925
225	525	750	350	550	475	700	200	400	575	675	875	875	1,650	1,375	1,175	1,650	1,375	1,175	1,350	1,175	925
200	525	750	350	550	500	700	225	400	575	675	850	850	1,650	1,375	1,175	1,650	1,375	1,175	1,350	1,175	950
175	550	775	375	575	500	725	250	425	525	675	800	800	1,650	1,375	1,175	1,650	1,375	1,175	1,350	1,175	950
150	550	775	375	575	500	725	250	425	500	700	775	775	1,650	1,375	1,175	1,650	1,375	1,175	1,350	1,175	950
125	550	775	400	575	525	725	275	450	500	700	750	750	1,675	1,375	1,175	1,675	1,375	1,175	1,350	1,175	950
100	550	775	400	575	525	725	275	450	500	700	725	750	1,675	1,400	1,175	1,675	1,400	1,175	1,350	1,175	950
75	550	775	400	575	525	725	300	450	500	700	700	750	1,675	1,400	1,200	1,675	1,400	1,200	1,350	1,175	950
50	550	775	400	600	525	725	300	450	500	700	675	775	1,675	1,400	1,200	1,675	1,400	1,200	1,350	1,200	950
25	550	775	400	600	525	725	300	450	500	700	650	775	1,675	1,400	1,200	1,675	1,400	1,200	1,350	1,200	950
0	550	775	400	600	525	725	300	450	500	700	650	775	1,675	1,400	1,200	1,675	1,400	1,200	1,350	1,200	950

HOB_{fs} = 30 m

Low HOB_{min} = 53 m

High HOB_{min} = 120 m

$HOB_{99} = HOB_{fs} + 3.5\ PE_h$ m

$HOB_{98} = HOB_{fs} + 3.0\ PE_h$ m

$HOB_{90} = HOB_{fs} + 1.9\ PE_h$ m

Figure 2.6a.

23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
HOB	Mod dam wheeled vehs	Mod dam tks and arty	Severe dam sup deps	Severe dam radios and elec equip	Severe dam hwy and RR brgs	Severe dam float bridge	2d-degree burns			1 PSI over-pressure	Induced contamination							
							Exposed skin	2-layer summer uniform	4-layer winter uniform		Intensity at GZ (rad/hr)				2 rad/hr radius			
											Type I	Type II	Type III	Type IV	Type I	Type II	Type III	Type IV.
825										1,550			0–5				0–500	
800										1,575			0–5				0–550	
775										1,600			0–10				0–550	
750							0			1,625			0–10				0–600	
725							200			1,650			0–10				0–650	
700							275			1,650			0–10				0–650	
675							325			1,675			0–15				0–700	
650							375			1,675			0–20				0–700	
625							425			1,675		0	0–20			0	0–750	
600							450			1,675		0–5	0–25			0–50	0–750	
575							475			1,700		0–5	0–30			0–200	0–800	
550							500			1,700		0–5	0–40			0–250	0–800	
525							525			1,700		0–5	0–50			0–300	0–800	
500							550			1,700		0–5	0–60			0–350	0–800	
475							575			1,700		0–10	0–90			0–400	0–850	
450							600			1,700		0–10	5–120			0–400	50–850	
425							625			1,700	0	0–15	10–150		0	0–450	150–900	
400							625			1,700	0–5	0–20	10–200		0–50	0–450	200–900	
375							650			1,675	0–5	0–25	15–260		0–150	0–500	250–900	
350							675	0		1,675	0–5	0–30	15–320		0–200	0–500	300–900	
325							675	125		1,650	0–5	0–35	20–400		0–250	0–500	350–900	
300				0			675	175		1,650	0–5	5–40	20–480		0–300	50–550	350–950	
275				25			700	200		1,625	0–10	5–50	25–580		0–300	150–550	400–950	
250				75			700	250		1,600	0–10	5–55	30–660		0–350	200–550	400–950	
225	0			125			725	250		1,600	0–10	5–65	35–780		0–350	200–600	400–950	
200	50		0	150		0	725	275	0	1,575	0–10	5–90	50–1,080		0–350	250–600	450–950	
175	150	0	25	175		250	725	300	50	1,550	0–15	5–110	60–1,320		0–400	250–600	450–950	
150	200	25	75	200		250	725	300	100	1,525	0–15	10–140	70–1,680		0–400	300–600	450–950	
125	225	50	100	225		250	750	325	125	1,500	0–20	10–185	90–2,220		0–400	300–600	450–950	
100	250	100	125	225	0	275	750	325	150	1,475	0–25	10–225	110–2,700		0–400	300–600	450–950	
75	250	150	125	250	225	275	750	325	175	1,450	0–35	15–290	140–3,500		0–400	300–600	450–950	
50	250	150	150	250	250	275	725	325	175	1,400	5–40	15–350	170–4,200	0	50–400	300–600	450–950	0
25	250	150	150	250	225	250	575	350	150	1,375	FALLOUT GOVERNS							
0	175	125	100	200	150	200	450	250	125	1,325								

Figure 2.6a continued.

[1] Medium-Range Cannon.

CASUALTY and DAMAGE Tables
Medium-Range Cannon
All figures in meters

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
HOB	Exposed personnel		Protected personnel		Personnel in APC's		Personnel in 1-m earth shelters		Personnel in multistory apt bldgs		Personnel in framehouses		Radius of safety								
													Unwarned, exposed			Warned, exposed			Warned, protected		
	Prompt	Delayed	Prompt	Delayed	Prompt	Delayed	Prompt	Delayed	Prompt	Delayed	Prompt	Delayed	Neg	Mod	Emer	Neg	Mod	Emer	Neg	Mod	Emer
900		0											1,975	1,300	950	1,525	1,200	950	1,125	800	325
875		175										0	1,975	1,300	950	1,525	1,200	950	1,150	825	400
850		275				0						175	2,000	1,325	975	1,550	1,225	975	1,150	850	450
825		350				175				0		275	2,000	1,350	1,000	1,550	1,250	1,000	1,175	875	500
800		400				250				100		350	2,025	1,350	1,025	1,575	1,275	1,025	1,200	900	525
775		450				325				225		400	2,025	1,375	1,050	1,575	1,275	1,050	1,225	925	575
750		475				375				300		450	2,025	1,400	1,075	1,600	1,300	1,075	1,225	950	600
725		525				425				350		475	2,050	1,400	1,075	1,600	1,300	1,075	1,250	975	625
700		550		0		475				400		525	2,050	1,400	1,100	1,625	1,325	1,100	1,250	1,000	650
675		575		125		500				450	0	550	2,050	1,425	1,100	1,625	1,325	1,100	1,275	1,000	675
650		600		225		525				475	300	575	2,075	1,425	1,125	1,650	1,350	1,125	1,275	1,025	700
625	0	625		275	0	550				500	375	600	2,075	1,450	1,150	1,650	1,350	1,150	1,300	1,050	725
600	150	650		325	150	600			0	525	450	625	2,075	1,450	1,150	1,650	1,375	1,150	1,300	1,050	750
575	250	675		375	225	625			150	550	525	650	2,100	1,475	1,175	1,675	1,375	1,175	1,325	1,075	775
550	300	700		400	275	625		0	225	575	600	675	2,100	1,475	1,175	1,675	1,400	1,175	1,325	1,075	800
525	325	725		450	325	650		100	275	600	750	750	2,100	1,500	1,200	1,675	1,400	1,200	1,350	1,100	800
500	375	725		475	375	675		200	325	625	900	900	2,100	1,500	1,200	1,700	1,400	1,200	1,350	1,100	825
475	400	750	0	500	400	700		250	350	650	1,075	1,075	2,125	1,500	1,200	1,700	1,425	1,200	1,350	1,125	825
450	425	775	125	525	425	700		275	400	675	1,175	1,175	2,125	1,500	1,225	1,700	1,425	1,225	1,375	1,125	850
425	450	775	200	550	450	725		325	425	675	1,175	1,175	2,125	1,525	1,225	1,700	1,425	1,225	1,375	1,125	850
400	475	800	250	550	475	750		350	450	700	1,200	1,200	2,125	1,525	1,250	1,725	1,450	1,250	1,375	1,150	875
375	500	800	275	575	500	750	0	375	625	700	1,200	1,200	2,150	1,525	1,250	1,725	1,450	1,250	1,400	1,150	875
350	525	825	300	600	500	775	100	400	675	725	1,175	1,175	2,150	1,525	1,250	1,725	1,450	1,250	1,400	1,150	900
325	525	825	325	600	525	775	175	425	675	725	1,175	1,175	2,150	1,550	1,250	1,725	1,450	1,250	1,400	1,175	900
300	550	825	350	625	550	775	200	450	675	750	1,125	1,125	2,150	1,550	1,275	1,725	1,475	1,275	1,400	1,175	900
275	550	850	375	625	550	800	250	450	675	750	1,100	1,100	2,150	1,550	1,275	1,750	1,475	1,275	1,425	1,175	925
250	575	850	400	625	575	800	275	475	650	750	1,050	1,050	2,150	1,550	1,275	1,750	1,475	1,275	1,425	1,175	925
225	575	850	400	650	575	800	300	475	650	775	1,025	1,025	2,150	1,550	1,275	1,750	1,475	1,275	1,425	1,200	925
200	575	875	425	650	600	825	300	500	625	775	975	975	2,150	1,550	1,275	1,750	1,475	1,275	1,425	1,200	950
175	600	875	425	675	600	825	325	500	600	775	950	950	2,175	1,575	1,300	1,750	1,475	1,300	1,425	1,200	950
150	600	875	450	675	600	825	325	525	575	800	925	925	2,175	1,575	1,300	1,750	1,500	1,300	1,425	1,200	950
125	600	875	450	675	600	825	350	525	575	800	900	900	2,175	1,575	1,300	1,750	1,500	1,300	1,425	1,200	950
100	600	875	450	675	625	825	350	525	575	800	850	850	2,175	1,575	1,300	1,750	1,500	1,300	1,425	1,200	950
75	625	875	450	675	625	850	350	525	600	800	825	875	2,175	1,575	1,300	1,750	1,500	1,300	1,450	1,200	950
50	625	900	450	675	625	850	350	525	600	800	800	875	2,025	1,550	1,300	1,750	1,500	1,300	1,450	1,200	950
25	625	900	475	675	625	850	375	525	600	800	775	875	1,900	1,525	1,300	1,750	1,500	1,300	1,450	1,200	950
0	625	900	475	675	625	850	375	525	600	800	775	875	1,750	1,500	1,300	1,750	1,500	1,300	1,450	1,200	950

HOB_{fs} = 38 m

Low HOB_{min} = 67 m

High HOB_{min} = 152 m

$HOB_{99} = HOB_{fs} + 3.5\ PE_h$ m

$HOB_{98} = HOB_{fs} + 3.0\ PE_h$ m

$HOB_{90} = HOB_{fs} + 1.9\ PE_h$ m

Figure 2.6b.

23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
							2d-degree burns				Induced contamination							
											Intensity at CZ (rad/hr)				2 rad/hr radius			
HOB	Mod dam wheeled vehicles	Mod dam tks and arty	Severe dam sup deps	Severe dam radios and elec equip	Severe dam hwy and RR brgs	Severe dam float brgs	Exposed skin	2-layer summer uniform	4-layer winter uniform	1 PSI over-pressure	Type I	Type II	Type III	Type IV	Type I	Type II	Type III	Type IV
900							550			2,075			0–5				0–500	
875							575			2,100			0–10				0–600	
850							625			2,100			0–10				0–650	
825							650			2,100			0–10				0–700	
800							675			2,100			0–10				0–700	
775							700			2,125			0–15				0–750	
750							725			2,125			0–15				0–750	
725							750			2,125		0	0–20			0	0–800	
700							775			2,125		0–5	0–20			0–50	0–600	
675							800			2,150		0–5	0–25			0–200	0–850	
650							825			2,150		0–5	0–35			0–300	0–850	
625							850			2,150		0–5	0–40			0–350	0–850	
600							850			2,150		0–5	5–50			0–400	50–900	
575							875			2,150		0–5	5–60			0–400	200–900	
550							900			2,150		0–10	5–75			0–450	250–900	
525							900			2,125	0	0–10	5–100		0	0–450	300–960	
500							925			2,125	0–5	0–10	5–120		0–50	0–300	350–950	
475							925	0		2,125	0–5	0–15	10–180		0–150	0–350	400–950	
450							950	150		2,100	0–5	0–20	10–230		0–250	0–550	400–1,000	
425							950	200		2,100	0–5	0–25	15–300		0–300	0–600	450–1,000	
400							975	250		2,075	0–5	0–35	20–400		0–300	0–600	450–1,000	
375				0			975	300		2,075	0–5	0–50	20–520		0–350	0–600	500–1,000	
350				25			1,000	325		2,050	0–10	5–60	25–640		0–400	50–650	500–1,000	
325				75			1,000	350		2,025	0–10	5–70	35–800		0–400	150–650	500–1,000	
300	0			125			1,000	375		2,025	0–10	5–80	40–940		0–400	200–650	550–1,050	
275	25			175		0	1,025	375	0	2,000	0–15	5–100	50–1,140		0–450	250–650	550–1,050	
250	100		0	200		250	1,025	400	50	1,975	0–15	5–110	60–1,320		0–450	250–700	550–1,050	
225	150	0	25	250		300	1,025	425	125	1,950	0–15	10–130	70–1,560		0–450	300–700	600–1,050	
200	250	25	75	250		325	1,025	425	150	1,925	0–20	10–180	90–2,160		0–500	300–700	600–1,050	
175	275	50	100	275		325	1,025	450	175	1,900	0–25	10–220	110–2,700		0–500	350–700	600–1,050	
150	300	100	125	300		350	1,050	450	200	1,875	0–35	15–280	140–3,400		0–500	350–700	600–1,050	
125	325	125	150	300	0	350	1,050	450	225	1,850	0–40	15–370	180–4,500		0–500	350–700	600–1,050	
100	350	175	175	325	275	350	1,050	475	225	1,825	5–50	20–450	220–5,400		50–500	350–700	600–1,050	
75	350	200	175	325	300	375	1,050	475	250	1,775	5–70	25–580	280–7,000	0	100–500	350–700	600–1,050	0
50	350	200	200	325	300	375	925	425	225	1,750	5–80	30–700	340–8,400	0–5	100–500	350–700	600–1,050	0–80
25	300	200	175	325	275	350	775	350	200	1,725	FALLOUT GOVERNS							
0	225	150	125	275	250	300	625	300	150	1,675								

Figure 2.6b continued.

[1]Medium-Range Cannon.

CONTINGENT EFFECTS Tables
Medium-Range Cannon

INDUCED RADIATION IN SOILS (See note 1.)
Fallout activity is not significant.

Yield KT	*HOB*	*Estimated radii in meters of 2 rad/hr contour of induced radiation 1 hour after burst. (See note 2.)*				*Estimated induced radiation intensity, 1 hour after burst, at GZ. In rad/hr. (See note 2.)*			
		Soil type I (Liberia, Africa)	*Soil type II (Nevada desert)*	*Soil type III (lava clay, Hawaii)*	*Soil type IV (beach sand, Pensacola, Fla)*	*Soil type I*	*Soil type II*	*Soil type III*	*Soil type IV*
BRAVO/1	Low	50–400	300–600	450–950	0	5–40	15–350	170–4,200	0
	High	0–400	300–600	450–950	0	0–25	10–225	110–2,700	0
CHARLIE/2	Low	100–500	350–700	600–1,050	0–50	5–80	30–700	340–8,400	0–5
	High	0–500	350–700	600–1,050	0	0–40	15–370	180–4,500	0

NOTES: 1. For description of chemical composition and effects of vsristions in chemical composition in soil types, see FM101-31-1, app III, annex F.

2. For range dependent delivery systems, intensities and 2 rad/hr contours are given for minimum ranges.

Figure 2.7a.

TREE BLOWDOWN (See note.)
All distances in meters

Yield KT	*OBSTACLES TO MOVEMENT*							*CASUALTIES TO EXPOSED PERSONNEL*		
	Foot and wheeled vehicle movement				*Tracked vehicle movement*					
	Type I	*Type II*	*Type III*	*Type IV*	*Type I*	*Types II, IVa(d)*	*Types III, IVa(f)*	*Type I*	*Types II, IVa(d)*	*Types III, IVa(f)*
BRAVO/1	300	400	400	700	300	400	400	200	300	300
CHARLIE/2	350	500	550	900	350	500	550	250	400	400

NOTE: These radii apply to all HOB. For general description of forest stand types and criteria, see FM 101-31-1, app III, annex F.

Figure 2.7b.

LIGHT AIRCRAFT IN FLIGHT (See note 1.)

Yield KT	*AIRCRAFT SAFETY RADII-meters (See note 2.)*		
	Light fixed wing	*Recon and obsn hel*	*Transport and util hel*
BRAVO/1	5,000	5,000	5,000
CHARLIE/2	6,000	6,000	5,000

NOTES: 1. These radii apply to all HOB. See FM 101-31-1, app III, annex F.

2. A buffer distance has been added to these radii of safety.

Figure 2.7c.

Yield KT	HOB	Expected radii for ignition of wildland fuels during fire season—meters							
		Dry climate (25 percent relative humidity)				Damp climate (75 percent relative humidity)			
		Class I	Class II	Class III	Class IV	Class I	Class II	Class III	Class IV
BRAVO/1	Air	1,100	1,000	900	700	1,000	1,000	800	600
CHARLIE/2	Air	1,400	1,300	1,000	800	1,300	1,300	1,100	800

NOTE: These radii apply to all HOB. For description of fuel classes, see FM 101-31-1, app III, annex F.

Figure 2.7d.

MRC 1

TACTICAL SYSTEM ACCURACY DATA
Medium-Range Cannon

All distances in meters

Range	Equivalent CEP[1]	Probable errors			Offset distance (d_o)	Range	Equivalent CEP[1]	Probable errors			Offset distance (d_o)
		PE_R	PE_D	PE_h				PE_R	PE_D	PE_h	
2,000	14	10	5	5	30	18,000	125	90	45	45	245
3,000	21	15	8	8	45	19,000	132	95	48	48	260
4,000	28	20	10	10	55	20,000	138	100	50	50	270
5,000	35	25	13	13	70						
6,000	42	30	15	15	85						
7,000	49	35	18	18	95						
8,000	56	40	20	20	110						
9,000	63	45	23	23	125						
10,000	69	50	25	25	135						
11,000	76	55	28	28	150						
12,000	83	60	30	30	165						
13,000	90	65	33	33	180						
14,000	97	70	35	35	190						
15,000	104	75	38	38	205						
16,000	111	80	40	40	220						
17,000	118	85	43	43	230						

[1]Equivalent CEP= $1.2345\ (PE_R^2 + PE_D^2)^{1/2}$.

Figure 2.8.

[1]Medium-Range Cannon.

INDUCED RADIATION IN SOILS (See note 1.)
Fallout activity is not significant.

Yield KT	*HOB*	*Estimated radii in meters of 2 rad/hr contour of induced radiation, 1 hour after burst. (See note 2.)*				*Estimated induced radiation intensity, 1 hour after burst, at GZ. In rad/hr (See note 2.)*			
		Soil type I (Liberia, Africa)	*Soil type II (Nevada desert)*	*Soil type III (lava clay, Hawaii)*	*Soil type IV (beach sand, Pensacola, Fla)*	*Soil type I*	*Soil type II*	*Soil type III*	*Soil type IV*
ALFA/.5	Low	0–350	150–550	450–850	0	0–20	10–175	85–2,100	0
	High	0–350	150–550	450–850	0	0–15	5–120	55–1,350	0
BRAVO/1	Low	50–400	300–600	450–950	0	5–40	15–350	170–4,200	0
	High	0–400	300–600	450–950	0	0–20	10–185	90–2,220	0
CHARLIE/2	Low	100–500	350–700	600–1,050	0–50	5–80	30–700	340–8,400	0–5
	High	0–500	350–700	600–1,050	0	0–35	15–280	140–3,400	0
DELTA/5	Low	200–550	450–800	700–1,150	0–150	10–160	60–1,450	700–17,400	0–5
	High	50–550	450–800	700–1,150	0	5–50	20–450	220–5,400	0
ECHO/10	Low	300–600	500–900	800–1,350	0–250	15–250	120–2,900	1,400–34,800	0–10
	High	200–550	450–900	800–1,350	0–50	5–65	25–550	270–6,600	0–5

NOTES: 1. For description of chemical composition and effects of variations in chemical composition in soil types, see FM 101-31-1, app III, annex F.

2. For range dependent delivery systems intensities and 2 rad/hr contours are given for minimum ranges.

Figure 4.7a.

TREE BLOWDOWN (See note.)
All distances in meters

Yield KT	*OBSTACLES TO MOVEMENT*							*CASUALTIES TO EXPOSED PERSONNEL*		
	Foot and wheeled vehicle movement				*Tracked vehicle movement*					
	Type I	*Type II*	*Type III*	*Type IV*	*Type I*	*Types II, IVa(d)*	*Types III, IVa(f)*	*Type I*	*Types II, IVa(d)*	*Types III, IVa(f)*
ALFA/.5	250	300	300	450	250	300	300	150	200	200
BRAVO/1	300	400	400	700	300	400	400	200	300	300
CHARLIE/2	350	500	550	900	350	500	550	250	400	400
DELTA/5	600	800	900	1,400	600	800	900	400	600	600
ECHO/10	750	1,000	1,100	1,900	750	1,000	1,100	600	800	900

NOTE: These radii apply to all HOB. For general description of forest stand types and criteria, see FM 101-31-1, app III, annex F.

Figure 4.7b.

LIGHT AIRCRAFT IN FLIGHT (See note 1.)

Yield KT	*AIRCRAFT SAFETY RADII-meters (See note 2.)*		
	Light fixed wing	*Recon and obsn hel*	*Transport and util hel*
ALFA/.5	4,000	4,000	4,000
BRAVO/1	5,000	5,000	5,000
CHARLIE/2	6,000	6,000	5,000
DELTA/5	9,000	9,000	7,000
ECHO/10	10,000	10,000	9,000

NOTES: 1. These radii apply to all HOB. See FM 101-31-1, app III, annex F.

2. A buffer distance has been added to these radii of safety.

Figure 4.7c.

CONTINGENT EFFECTS Tables (continued)
Small Free Rocket

FIRE AREAS (See note.)

Yield KT	HOB	Expected radii for ignition of wildland fuels during fire season—meters							
		Dry climate (25 percent relative humidity)				Damp climate (75 percent relative humidity)			
		Class I	Class II	Class III	Class IV	Class I	Class II	Class III	Class IV
ALFA/.5	Air	800	700	700	600	700	700	600	400
	Impact	500	500	400	400	500	500	400	400
BRAVO/1	Air	1,100	1,000	900	700	1,000	1,000	800	600
	Impact	700	600	500	500	600	600	500	400
CHARLIE/2	Air	1,400	1,300	1,000	800	1,300	1,300	1,100	800
	Impact	900	800	700	600	800	800	700	500
DELTA/5	Air	2,000	1,800	1,700	1,400	1,800	1,800	1,500	1,100
	Impact	1,200	1,100	1,000	800	1,100	1,100	900	700
ECHO/10	Air	2,600	2,400	2,200	1,800	2,400	2,400	2,100	1,500
	Impact	1,500	1,400	1,300	1,100	1,400	1,400	1,200	900

NOTE: These radii apply to all HOB. For description of fuel classes, see FM 101-31-1, app III, annex F.

Figure 4.7.d

CRATER DIMENSIONS (See note.)

Yield KT	Approx crater dimensions for various soil types—meters							
	Hard rock (Granite and sandstone)		Soft rock (dry soil or soft rock)		Saturated soil (water slowly fills crater)		Saturated soil (water rapidly fills crater)	
	Radius	Depth	Radius	Depth	Radius	Depth	Radius	Depth
ALFA/.5	13	5	16	6	24	8	31	4
BRAVO/1	16	6	20	7	30	10	39	5
CHARLIE/2	20	6	25	8	37	12	50	6
DELTA/5	27	8	34	10	50	15	67	7
ECHO/10	34	10	42	12	63	18	84	8

NOTE: Based on contact surface burst, for more detailed analysis, see engineer element.

Figure 4.7e.

TACTICAL SYSTEM ACCURACY DATA
Small Free Rocket

All distances in meters

Range	Equivalent CEP[1]	Probable errors			Offset distance (d_o)	Range	Equivalent CEP[1]	Probable errors			Offset distance (d_o)
		PE_R	PE_d	PE_h				PE_R	PE_d	PE_h	
3,000	42	15	30	15	85	19,000	263	95	190	95	515
4,000	56	20	40	20	110	20,000	276	100	200	100	540
5,000	69	25	50	25	135	21,000	290	105	210	105	570
6,000	83	30	60	30	165	22,000	304	110	220	110	595
7,000	97	35	70	35	190	23,000	318	115	230	115	625
8,000	111	40	80	40	220	24,000	332	120	240	120	650
9,000	125	45	90	45	245	25,000	345	125	250	125	675
10,000	138	50	100	50	270						
11,000	152	55	110	55	300						
12,000	166	60	120	60	325						
13,000	180	65	130	65	355						
14,000	194	70	140	70	380						
15,000	207	75	150	75	405						
16,000	221	80	160	80	435						
17,000	235	85	170	85	460						
18,000	249	90	180	90	490						

[1]Equivalent CEP= $1.2345\ (PE_R^2 + PE_d^2)^{1/2}$.

Figure 4.8.

[1]Small Free Rocket.

CONTINGENT EFFECTS Tables
Large Free Rocket

INDUCED RADIATION IN SOILS (See note 1.)
Fallout activity is not significant.
Impact burst not tabulated, fallout governs.

Yield KT	HOB	Estimated radii in meters of 2 rad/hr contour of induced radiation, one hour after burst.				Estimated induced radiation intensity, one hour after burst, at GZ. In rad/hr.			
		Soil type I (Liberia, Africa)	Soil type II (Nevada desert)	Soil type III (lava clay, Hawaii)	Soil type IV (beach sand, Pensacola, Fla)	Soil type I	Soil type II	Soil type III	Soil type IV
DELTA/5	Low	200–550	450–800	700–1,150	0–150	5–125	50–1,140	540–13,500	0–5
	High	0–550	400–800	700–1,150	0	0–35	15–325	160–3,900	0
ECHO/10	Low	300–600	500–900	800–1,350	0–250	10–250	90–2,250	1,080–27,000	0–10
	High	150–550	450–900	800–1,350	0	5–55	20–470	230–5,640	0
FOXTROT/20	Low	350–750	600–1,000	900–1,400	0–300	20–410	150–3,700	1,780–44,000	0–10
	High	150–700	500–950	850–1,400	0	5–75	30–660	320–7,920	0
GOLF/50	Low	450–800	700–1,150	1,050–1,550	0–400	15–310	110–2,750	1,320–33,000	0–10
	High	250–700	550–1,100	1,000–1,500	0–50	5–55	20–475	230–5,700	0–5
HOTEL/100	Low	550–900	800–1,250	1,150–1,650	0–500	40–990	360–9,000	4,320–108,000	0–25
	High	100–750	650–1,150	1,050–1,650	0	5–50	20–410	200–4,920	0

NOTE: For description of chemical composition and effects of variations in chemical composition in soil types, see FM 101-31-1, app III, annex F.

Figure 5.7a.

TREE BLOWDOWN (See note.)
All distances in meters

Yield KT	OBSTACLES TO MOVEMENT							CASUALTIES TO EXPOSED PERSONNEL		
	Foot and wheeled vehicle movement				Tracked vehicle movement					
	Type I	Type II	Type III	Type IV	Type I	Types II, IVa(d)	Types III, IVa(f)	Type I	Types II, IVa(d)	Types III, IVa(f)
DELTA/5	600	800	900	1,400	600	800	900	400	600	600
ECHO/10	750	1,000	1,100	1,900	750	1,000	1,100	600	800	900
FOXTROT/20	1,050	1,300	1,500	2,400	1,050	1,300	1,500	750	1,000	1,150
GOLF/50	1,650	2,100	2,500	3,900	1,650	2,100	2,100	1,200	1,550	1,700
HOTEL/100	2,000	2,600	3,100	5,000	2,000	2,600	3,100	1,700	2,000	2,250

NOTE: These radii apply to all HOB. For general description of forest stand types and criteria, see FM 101-31-1, app III, annex F.

Figure 5.7b.

LIGHT AIRCRAFT IN FLIGHT (See note 1.)

Yield KT	AIRCRAFT SAFETY RADII—meters (See note 2.)		
	Light fixed wing	Recon and obsn hel	Transport and util hel
DELTA/5	9,000	9,000	7,000
ECHO/10	10,000	10,000	9,000
FOXTROT/20	13,000	13,000	11,000
GOLF/50	17,000	17,000	15,000
HOTEL/100	22,000	21,000	18,000

NOTES: 1. These radii apply to all HOB. See FM 101-31-1, app III, annex F.

2. A buffer distance has been added to these radii of safety.

Figure 5.7c.

CHAPTER 6
LIGHT GUIDED MISSILE

6.1 GENERAL

a. Orientation. This chapter contains employment data for the light guided missile with its associated warhead sections fired from a mobile launcher.

b. Weapon characteristics.

(1) *Yield.* The warhead sections for the light guided missile have yields of Alfa/0.5 KT, Bravo/1 KT, Charlie/2 KT, Delta/5 KT, Echo/10 KT, and Foxtrot/20 KT.

(2) *Fuzing.*

(*a*) The fuzing for the light guided missile provides airburst and impact fuzing options. The airburst option is radar-fuzed and can be set for either high or low airburst; these are the only heights of burst available. When the fuze is set for an airburst, the system provides for an option of either contact backup or contact preclusion.

(*b*) The fuzes are preset at the following heights of burst:

Warhead section	*HOB option*	*HOB (meters)*	*PE_h (meters)*
Alfa/0.5 KT	low	129	30
	high	189	
Bravo/1 KT	low	135	30
	high	210	
Charlie/2 KT	low	143	30
	high	238	
Delta/5 KT	low	157	30
	high	285	
Echo/10 KT	low	170	30
	high	332	
Foxtrot/20 KT	low	187	30
	high	391	

(3) *Preinitiation.* See figure 13.7 for the necessary considerations where a multiple weapon attack is desired.

c. Employment considerations.

(1) *Range.* The minimum and maximum ranges of the light guided missile are 10,000 meters and 50,000 meters.

(2) *Tactical system accuracy.* The tactical system errors for the light guided missile are independent of range. A circular error probable (CEP) of 100 meters has been used in the computation of the weapon selection tables. The vertical probable error (PE_h) is 30 meters. LGM 1

(3) *Unit carrying capacity.* A light guided missile unit can draw, transport, and store at any one time a total of 12 complete rounds per battalion.

(4) *Response time.* The times shown below can be used as a basis for general tactical planning. They are considered to be applicable to a reasonably well-trained unit operating in daylight under favorable weather conditions. Blackout operations, unfavorable weather, enemy interference, equipment breakdown, or faulty test indications will extend the times listed. *For detailed tactical planning, the response times should be the actual times obtained from the artillery unit concerned.*

Situation	*Time (minutes)*	*Remarks*
I[1]	30	For situation I, add 20 minutes if warhead section must be removed and a new warhead section with required yield mated to missile.
II[2]	10	

[1]Situation I (high readiness)—the complete round and launcher are in a firing position and survey is completed. Preliminary firing data for a specific target are not available. Prefire checkouts which can be performed prior to the receipt of a fire mission have been completed. (May be used to engage targets of opportunity.)

[2]Situation II (maximum readiness)—firing data for a specific target have been computed and applied to the weapon system. The unit is awaiting an order to fire. (Typical of readiness to engage on-call target).

(5) *Special considerations.* The target analyst needs no special information from the unit fire direction center for target analysis. For an airburst fuzing option, the fire mission to the unit includes the radar height of burst (HOB) setting, high or low; it also includes whether contact backup or contact preclusion is desired. When contact backup is chosen, a fallout prediction is made. When an impact fuzing option is selected, the fire mission specifies HOB impact.

[1]Light Guided Missile.

CHAPTER 9
FIGHTER AIRCRAFT

9.1 GENERAL

a. Orientation. This chapter contains employment data for the nuclear bombs delivered by fighter aircraft.

b. Weapon characteristics.

(1) *Yield.* The bombs carried by fighter aircraft have yields of Delta/5 KT, Echo/10 KT, Foxtrot/20 KT, Golf/50 KT, Hotel/100 KT, India/200 KT, Juliett/500 KT, and Kilo/1 MT.

(2) *Fuzing.*

(*a*) The fuzing for these bombs provides airburst and impact fuzing options. The airburst option is radar-fuzed and can be set for either high or low airburst; these are the only heights of burst available. Contact backup is provided in all cases where the airburst option is selected.

(*b*) The fuzes are preset at the following heights of burst:

Warhead section	*HOB option*	*HOB (meters)*	PE_h *(meters)*
Delta/5 KT	low	227	50
	high	355	
Echo/10 KT	low	240	50
	high	402	
Foxtrot/20 KT	low	257	50
	high	461	
Golf/50 KT	low	286	50
	high	562	
Hotel/100 KT	low	315	50
	high	663	
India/200 KT	low	502	50
	high	790	
Juliett/500 KT	low	620	50
	high	1,009	
Kilo/1 MT	low	735	50
	high	1,225	

(3) *Preinitiation.* See figure 13.7 for the necessary considerations where a multiple weapon attack is desired.

c. Employment considerations.

(1) *Range.* The radius of action for fighter aircraft varies depending on the type fighter used. For training purposes only, a maximum radius of action of 800 kilometers is assumed. In an actual situation, the delivery unit concerned is consulted to obtain this information.

(2) *Tactical system accuracy.* Horizontal dispersion is dependent on the proficiency of the aircraft pilot and crew, and the technique of delivery. The CEP used in this chapter for fighter delivery is an average value for well-trained crews. A CEP of 250 meters has been used in the computation of the weapon selection tables. The vertical probable error is 50 meters.

(3) *Response time.* The times shown below can be used as a basis for general tactical planning. For detailed tactical planning, the *response times should be the actual times obtained from the delivery unit concerned.* The times listed below are average times for normal operations after alert. Such factors as distance and routes to the bomb storage area, type of transportation, type of ground handling equipment, and enemy action influence bomb preparation and loading.

Situation	*Time (minutes)*	*Remarks*
I[1]	60	(*a*) In both situations, flight time must be added to the times shown. (*b*) Time may vary in situation I as distance from storage area to aircraft varies.
II[2]	10	

[1]Situation I (ready)—bomb is partially assembled and tested to allow shortest assembly time. The bomb is located in a storage area.

[2]Situation II (strike)—bomb is assembled and loaded on the aircraft. The aircraft and crew are on ground alert.

(4) *Special considerations.* The target analyst coordinates closely with the liaison officer representing the delivery unit concerned. The analyst needs to know the CEP involved, because CEP varies depending on the crew assigned and the delivery technique used to attack the target. (See para 9.1*c*(2), above, for assumption made for the weapon on selection tables that follow.) When an airburst fuzing option is selected, the fire mission states the desired radar HOB setting as high or low. When an impact fuzing option is selected, the fire mission specifies HOB impact. When employing these weapons, a fallout prediction is always made.

FTR ACFT 1

[1]Fighter Aircraft.

CONTINGENT EFFECTS Tables
Fighter Aircraft

INDUCED RADIATION IN SOILS (See note 1.)
Fallout activity is not significant.
Impact burst not tabulated, fallout governs.

Yield KT	*HOB*	*Estimated radii in meters of 2 rad/hr contour of induced radiation, 1 hour after burst.*				*Estimated induced radiation intensity, 1 hour after burst, at GZ. In rad/hr.*			
		Soil type I (Liberia, Africa)	*Soil type II (Nevada desert)*	*Soil type III (lava clay, Hawaii)*	*Soil type IV (beach sand, Pensacola, Fla)*	*Soil type I*	*Soil type II*	*Soil type III*	*Soil type IV*
DELTA/5	Low	200–550	450–800	700–1,150	0–100	5–100	40–940	450–11,000	0–5
	High	0–500	400–800	700–1,150	0	0–35	15–275	140–3,300	0
ECHO/10	Low	300–600	500–900	800–1,350	0–250	10–200	75–1,850	900–22,200	0–5
	High	50–550	400–850	750–1,350	0	5–45	20–390	200–4,680	0
FOXTROT/20	Low	350–750	600–1,000	900–1,400	0–300	15–310	120–2,800	1,350–33,600	0–10
	High	50–700	500–950	850–1,400	0	5–60	25–530	260–2,360	0
GOLF/50	Low	500–800	700–1,150	1,050–1,550	0–450	25–610	220–5,500	2,640–66,000	0–15
	High	250–700	550–1,100	1,000–1,500	0–50	5–55	20–475	230–5,700	0–5
HOTEL/100	Low	550–900	800–1,250	1,150–1,650	0–500	40–990	360–9,000	4,320–108,000	0–25
	High	50–750	600–1,150	1,050–1,600	0	5–35	15–310	150–3,720	0
INDIA/200	Low	450–950	750–1,300	1,200–1,800	0–400	15–370	135–3,300	1,590–39,600	0–10
	High	0–800	550–1,200	1,100–1,700	0	0–30	15–260	125–3,120	0
JULIETT/500	Low	500–1,050	900–1,450	1,350–1,900	0–500	15–280	100–2,500	1,200–30,000	0–10
	High	0–750	450–1,200	1,100–1,750	0	0–10	5–90	45–1,080	0
KILO/1,000	Low	550–1,200	950–1,550	1,400–2,000	0–450	10–220	80–2,000	960–24,000	0–10
	High	0–700	50–1,250	1,050–1,750	0	0–10	5–50	25–580	0

NOTE: For description of chemical composition and effects of variations in chemical composition in soil types, see FM 101-31-1, app III, annex F.

Figure 9.7a.

TREE BLOWDOWN (See note.)
All distances in meters

Yield KT	*OBSTACLES TO MOVEMENT*							*CASUALTIES TO EXPOSED PERSONNEL*		
	Foot and wheeled vehicle movement				*Tracked vehicle movement*					
	Type I	*Type II*	*Type III*	*Type IV*	*Type I*	*Types II, IVa(d)*	*Types III, IVa(f)*	*Type I*	*Types II, IVa(d)*	*Types III, IVa(f)*
DELTA/5	600	800	900	1,400	600	800	900	400	600	600
ECHO/10	750	1,000	1,100	1,900	750	1,000	1,100	600	800	900
FOXTROT/20	1,050	1,300	1,500	2,400	1,050	1,300	1,500	750	1,000	1,150
GOLF/50	1,650	2,100	2,500	3,900	1,650	2,100	2,500	1,200	1,550	1,700
HOTEL/100	2,000	2,600	3,100	5,000	2,000	2,600	3,100	1,700	2,000	2,250
INDIA/200	2,450	3,200	3,800	6,200	2,450	3,200	3,800	2,000	2,400	2,700
JULIETT/500	3,750	4,800	6,000	9,400	3,750	4,800	6,000	3,150	3,600	4,200
KILO/1,000	5,000	6,200	7,700	12,000	5,000	6,200	7,700	4,050	4,600	5,200

NOTE: These radii apply to all HOB. For general description of forest stand types and criteria, see FM 101-31-1, app III, annex F.

Figure 9.7b.

LIGHT AIRCRAFT IN FLIGHT (See note 1.)

Yield KT	*AIRCRAFT SAFETY RADII—meters (See note 2.)*		
	Light fixed wing	*Recon and obsn hel*	*Transport and util hel*
DELTA/5	9,000	9,000	7,000
ECHO/10	10,000	10,000	9,000
FOXTROT/20	13,000	13,000	11,000
GOLF/50	17,000	16,000	15,000
HOTEL/100	22,000	21,000	18,000
INDIA/200	27,000	26,000	23,000
JULIETT/500	35,000	34,000	31,000
KILO/1,000	43,000	42,000	40,000

NOTES: 1. These radii apply to all HOB. See FM 101-31-1, app III, annex F.

2. A buffer distance has been added to these radii of safety.

Figure 9.7c.

CHAPTER 10
TACTICAL BOMBER

10.1 GENERAL

a. Orientation. This chapter contains employment data for the nuclear bombs delivered by tactical bombers.

b. Weapon characteristics.

(1) *Yield.* The bombs carried by tactical bombers have yields of Hotel/100 KT, India/200 KT, Juliett/500 KT, Kilo/1 MT, Lima/2 MT, and Mike/5 MT.

(2) *Fuzing.*

(*a*) The fuzing for these bombs provides airburst and impact fuzing options. The airburst option is radar-fuzed and can be set for either high or low airburst; these are the only heights of burst available. Contact backup is provided in all cases where the airburst option is selected. The Hotel/100 KT weapon *only* has, in addition, a subsurface burst capability fuzed hy a time delay fuze. This option can be selected only as a primary means of detonation.

(*b*) The fuzes are preset at the following heights of burst:

Warhead section	*HOB option*	*HOB (meters)*	PE_h *(meters)*
Hotel/100 KT	low	490	100
	high	838	
India/200 KT	low	677	100
	high	965	
Juliett/500 KT	low	795	100
	high	1,184	
Kilo/1 MT	low	910	100
	high	1,400	
Lima/2 MT	low	1,056	100
	high	1,673	
Mike/5 MT	low	1,308	100
	high	2,146	

(3) *Preinitiation.* See figure 13.7 for the necessary considerations where a multiple weapon attack is desired.

c. Employment considerations.

(1) *Range.* The radius of action for tactical bombers varies depending on the type bomber used. For training purposes only, a maximum radius of action of 1,200 kilometers is assumed. In an actual situation, the delivery unit concerned is consulted to obtain this information.

(2) *Tactical system accuracy.* Horizontal dispersion is dependent on the proficiency of the aircraft pilot and crew and the technique of delivery. The CEP used in this chapter for tactical bomber delivery is an average value for well-trained crews. A CEP of 600 meters has been used in the computation of the weapon selection tables. The vertical probable error is 100 meters.

(3) *Response time.* The times shown below can be used as a basis for general tactical planning. For detailed tactical planning, the *response times should be the actual times obtained from the delivery unit concerned.* The times listed below are average times for normal operations after alert. Such factors as distance and routes to the bomb storage area, type of transportation, type of ground handling equipment, and enemy action influence bomb preparation and loading.

Situation	*Time (minutes)*	*Remarks*
I[1]	120	(*a*) In both situations, flight time must be added to the times shown. (*b*) Time may vary in situation I as distance from storage area to aircraft varies.
II[2]	20	

[1]Situation I (ready)—bomb is partially assembled and tested to allow shortest assembly time. The bomb is located in a storage area.

[2]Situation II (strike)—bomb is assembled and loaded on the aircraft. The aircraft and crew are on ground alert.

TAC BMR 1

(4) *Special considerations.* The target analyst coordinates closely with the liaison officer representing the delivery unit concerned. The analyst needs to know the CEP involved, because CEP varies depending on the crew assigned and the delivery technique used to attack the target. (See para 10.1*c*(2), above, for assumption made for the weapon selection tables that follow.) When an airburst fuzing option is selected, the fire mission states the desired radar HOB setting as high or low. When an impact fuzing option is selected, the fire mission specifies HOB impact. When employing these weapons, a fallout prediction is always made. When a subsurface burst fuzing option is selected for the Hotel/100 KT weapon, the fire mission specifies HOB subsurface.

[1]Tactical Bomber.

CONTINGENT EFFECTS Tables
Tactical Bomber

INDUCED RADIATION IN SOILS (See note 1.)
Fallout activity is not significant.
Impact burst not tabulated, fallout governs.

Yield KT	*HOB*	*Estimated radii in meters of 2 rad/hr contour of induced radiation, 1 hour after burst.*				*Estimated induced radiation intensity, 1 hour after burst, at GZ. In rad/hr*			
		Soil type I (Liberia, Africa)	*Soil type II (Nevada desert)*	*Soil type III (lava clay, Hawaii)*	*Soil type IV (beach sand, Pensacola, Fla)*	*Soil type I*	*Soil type II*	*Soil type III*	*Soil type IV*
HOTEL/100	Low	500–850	750–1,250	1,150–1,650	0–400	20–430	160–3,900	1,880–46,800	0–15
	High	0–700	500–1,100	1,000–1,550	0	0–20	10–160	90–1,920	0
INDIA/200	Low	400–900	750–1,300	1,200–1,750	0–350	10–210	80–1,900	920–22,800	0–5
	High	0–700	400–1,150	1,050–1,650	0	0–15	5–110	55–1,320	0
JULIETT/500	Low	400–1,000	800–1,400	1,300–1,900	0–400	5–110	40–1,000	480–12,000	0–5
	High	0–650	300–1,200	1,050–1,750	0	0–10	5–65	35–780	0
KILO/1,000	Low	400–1,100	900–1,500	1,350–1,950	0–300	5–95	35–825	400–9,900	0–5
	High	0–500	0–1,150	900–1,700	0	0–5	0–25	15–300	0
LIMA/2,000	Low	350–1,150	850–1,550	1,450–2,000	0	5–60	25–520	250–6,240	0
	High	0	0–1,050	900–1,650	0	0	0–20	10–190	0
MIKE/5,000	Low	0–1,100	800–1,600	1,400–2,050	0	0–30	10–240	120–2,880	0
	High	0	0–50	0–1,300	0	0	0–5	0–25	0
	Low								
	High								
	Low								
	High								

NOTE: For description of chemical composition and effects of variationa in chemical composition in soil typea, see FM 101-31-1, app III, annex F.

Figure 10.7a.

TREE BLOWDOWN (See note.)
All distances in meters

Yield KT	*OBSTACLES TO MOVEMENT*							*CASUALTIES TO EXPOSED PERSONNEL*		
	Foot and wheeled vehicle movement				*Tracked vehicle movement*					
	Type I	*Type II*	*Type III*	*Type IV*	*Type I*	*Types II, IVa(d)*	*Types III, IVa(f)*	*Type I*	*Types II, IVa(d)*	*Types III, IVa(f)*
HOTEL/100	2,000	2,600	3,100	5,000	2,000	2,600	3,100	1,700	2,000	2,250
INDIA/200	2,450	3,200	3,800	6,200	2,450	3,200	3,800	2,000	2,400	2,700
JULIETT/500	3,750	4,800	6,000	9,400	3,750	4,800	6,000	3,150	3,600	4,200
KILO/1,000	5,000	6,200	7,700	12,000	5,000	6,200	7,700	4,050	4,600	5,200
LIMA/2,000	5,800	7,400	9,600	14,500	5,800	7,400	9,600	4,600	5,200	6,500
MIKE/5,000	8,600	12,000	14,500	22,000	8,600	12,000	14,500	7,000	8,000	9,600

NOTE: These radii apply to all HOB. For general description of foreat atand types and criteria, aee FM 101-31-1, app III, annex F.

Figure 10.7b.

LIGHT AIRCRAFT IN FLIGHT (See note 1.)

Yield KT	*AIRCRAFT SAFETY RADII-meters (See note 2.)*		
	Light fixed wing	*Recon and obsn hel*	*Transport and util hel*
HOTEL/100	22,000	21,000	18,000
INDIA/200	27,000	26,000	23,000
JULIETT/500	35,000	34,000	31,000
KILO/1,000	43,000	42,000	40,000
LIMA/2,000	51,000	50,000	47,000
MIKE/5,000	62,000	61,000	58,000

NOTES: 1. Theae radii apply to all HOB. See FM 101-31-1, app III, annex F.

2. A buffer diatance has been added to these radii of safety.

Figure 10.7c.

CHAPTER 11
STRATEGIC BOMBER

11.1 GENERAL

a. Orientation. This chapter contains employment data for the nuclear bombs delivered by strategic bombers.

b. Weapon characteristics.

(1) *Yield.* The bombs carried by strategic bombers have yields of Kilo/1 MT, Lima/2 MT, and Mike/5 MT.

(2) *Fuzing.*

(*a*) The fuzing for these bombs provides airburst and impact fuzing options. The airburst option is radar-fuzed and can be set for either high or low airburst; these are the only heights of burst available. Contact backup is provided in all cases where the airburst option is selected.

(*b*) The fuzes are preset at the following heights of burst:

Warhead section	*HOB option*	*HOB (meters)*	PE_h *(meters)*
Kilo/1 MT	low	1,260	200
	high	1,750	
Lima/2 MT	low	1,406	200
	high	2,023	
Mike/5 MT	low	1,658	200
	high	2,496	

(3) *Preinitiation.* See figure 13.7 for the necessary considerations where a multiple weapon attack is desired.

c. Employment considerations.

(1) *Range.* The radius of action for strategic bombers varies depending on the type bomber used. For training purposes only, a maximum radius of action of 2,400 kilometers is assumed. In an actual situation, the delivery unit concerned is consulted to obtain this information.

(2) *Tactical system accuracy.* Horizontal dispersion is dependent on the proficiency of the aircraft pilot and crew, and the technique of delivery. The CEP used in this chapter for delivery by strategic bomber is an average value for well-trained crews. A CEP of 2,000 meters has been used in the computation of the weapon selection tables. The vertical probable error is 200 meters.

(3) *Response time.* The times shown below can be used as a basis for general tactical planning. *For detailed tactical planning, the response times should be the actual times obtained from the delivery unit concerned.* The times listed below are average times only for normal operations after alert. Such factors as distance and routes to the bomb storage areas, type of transportation, type of ground handling equipment, and enemy action influence bomb preparation and loading.

Situation	*Time (minutes)*	*Remarks*
I[1]	360	(*a*) In both situations, flight time must be added to the times shown. (*b*) Time may vary in situation I as distance from storage area to aircraft varies.
II[2]	30	

[1]Situation I (ready)—bomb is partially assembled and tested to allow shortest assembly time. The bomb is located in a storage area.

[2]Situation II (strike)—bomb is assembled and loaded on the aircraft. The aircraft and crew are on ground alert.

(4) *Special considerations.* The target analyst coordinates closely with the liaison officer representing the delivery unit concerned. The analyst needs to know the CEP involved, because CEP varies depending on the crew assigned and the delivery technique to be used to attack the target. (See para 11.1c(2), above, for assumption made for the weapon selection tables that follow.) When an airburst fuzing option is selected, the fire mission states the desired radar HOB setting as high or low. When an impact fuzing option is selected, the fire mission specifies HOB impact. When employing these weapons, a fallout prediction is always made.

STRAT
BMR 1

[1]Strategic Bomber.

Yield	HOB option (HOB–meters)	Minimum safe distance (negligible risk, UnW Ex)	FRACTION OF TARGET COVERED. In the column under each target radius, the first figure is the probable minimum coverage; the second figure is the average coverage.																	Offset distance d_o
			WHEELED VEHICLES									TANKS AND ARTILLERY								
			Target radius (meters)								Prob min R_D	Target radius (meters)								Prob min R_D
KT	(See note)	(meters)	2,400	3,200	4,000	4,800	5,600	6,400	7,200	8,000	(meters)	400	800	1,200	1,600	2,000	2,400	2,800	3,200	(meters)	(meters)
1,000	High (1,750)	32,400	.0/.4	.0/.3	.0/.3	.0/.2	.0/.2	.0/.1			600	.0/.0								0	3,660 (all yields)
	Low (1,260)	32,400	.3/.7	.3/.6	.3/.5	.2/.4	.2/.4	.2/.3	.1/.2	.1/.2	2,975	.0/.2	.0/.2	.0/.2	.0/.2	.0/.1				150	
	Impact	*19,100	.2/.6	.2/.5	.2/.4	.2/.3	.2/.2	.1/.2	.1/.2	.1/.1	2,775	.0/.4	.0/.4	.0/.4	.0/.4	.0/.3	.0/.3	.1/.3	.1/.2	1,850	
			Target radius (meters)								Prob min R_D	Target radius (meters)								Prob min R_D	
			4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000	(meters)	800	1,600	2,400	3,200	4,000	4,800	5,600	6,400	(meters)	
2,000	High (2,023)	41,000	.1/.5	.1/.4	.0/.3	.0/.3	.0/.2	.0/.2	.0/.1		1,750	.0/.1								0	
	Low (1,406)	41,000	.5/.8	.5/.7	.4/.6	.3/.5	.3/.4	.2/.3	.1/.2	.1/.2	4,450	.0/.4	.0/.3	.0/.3	.0/.2	.0/.2	.0/.1			825	
	Impact	*24,100	.4/.6	.3/.5	.3/.4	.2/.3	.1/.2	.1/.2	.1/.1		3,675	.0/.6	.1/.5	.1/.5	.2/.4	.2/.3	.2/.2	.1/.2	.1/.1	2,450	
			Target radius (meters)								Prob min R_D	Target radius (meters)								Prob min R_D	
			4,000	6,000	8,000	10,000	12,000	14,000	16,000	18,000	(meters)	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	(meters)	
5,000	High (2,496)	*58,800	.7/.9	.5/.7	.4/.5	.3/.4	.2/.3	.1/.2	.1/.2	.1/.1	5,375	.0/.2	.0/.1							100	
	Low (1,658)	58,800	.9/.9	.7/.9	.6/.7	.4/.5	.3/.4	.2/.3	.1/.2	.1/.2	6,950	.2/.7	.2/.6	.2/.5	.1/.4	.1/.3	.0/.2	.0/.2	.0/.1	2,125	
	Impact	*33,200	.6/.8	.5/.6	.3/.4	.2/.3	.1/.2	.1/.1			5,300	.4/.8	.4/.7	.3/.5	.3/.4	.2/.3	.2/.3	.1/.2	.1/.2	3,525	

NOTE: High airburst–Reduces intensity of induced contamination. Precludes fallout.
Low airburst–Precludes fallout.
Impact burst–Produces fallout.

*Initial effects only. Fallout governs.

Figure 11.3.

STRAT
BMR 1

[1]Strategic Bomber.

CONTINGENT EFFECTS Tables
Strategic Bomber

INDUCED RADIATION IN SOILS (See Note 1.)
Fallout activity is not significant.
Impact burst not tabulated, fallout governs.

Yield KT	HOB	Estimated radii in meters of 2 rad/hr contour of induced radiation, 1 hour after burst.				Estimated induced radiation intensity, 1 hour after burst, at GZ. In rad/hr.			
		Soil type I (Liberia, Africa)	Soil type II (Nevada desert)	Soil type III (lava clay, Hawaii)	Soil type IV (beach sand, Pensacola, Fla)	Soil type I	Soil type II	Soil type III	Soil type IV
KILO/1,000	Low	0–1,000	700–1,450	1,250–1,900	0	0–30	15–260	125–3,120	0
	High	0–50	0–1,050	750–1,600	0	0–5	0–15	10–170	0
LIMA/2,000	Low	0–1,000	700–1,450	1,350–1,950	0	0–25	10–190	95–2,280	0
	High	0	0–700	400–1,450	0	0	0–5	5–55	0
MIKE/5,000	Low	0–1,000	650–1,500	1,300–2,000	0	0–15	5–125	60–1,500	0
	High	0	0	0–950	0	0	0	0–10	0

NOTE: For description of chemical composition and effects of variations in chemical composition in soil types, see FM 101-31-1, app III, annex F.

Figure 11.7a.

TREE BLOWDOWN (See Note.)
All distances in meters

Yield KT	OBSTACLES TO MOVEMENT							CASUALTIES TO EXPOSED PERSONNEL		
	Foot and wheeled vehicle movement				Tracked vehicle movement					
	Type I	Type II	Type III	Type IV	Type I	Types II, IVa(d)	Types III, IVa(f)	Type I	Types II, IVa(d)	Types III, IVa(f)
KILO/1,000	5,000	6,200	7,700	12,000	5,000	6,200	7,700	4,050	4,600	5,200
LIMA/2,000	5,800	7,400	9,600	14,500	5,800	7,400	9,600	4,600	5,200	6,500
MIKE/5,000	8,600	12,000	14,500	22,000	8,600	12,000	14,500	7,000	8,000	9,600

NOTE: These radii apply to all HOB. For general description of forest stand types and criteria, see FM 101-31-1, app III, annex F.

Figure 11.7b.

LIGHT AIRCRAFT IN FLIGHT (See Note 1.)

Yield KT	AIRCRAFT SAFETY RADII—meters (See note 2.)		
	Light fixed wing	Recon and obsn hel	Transport and util hel
KILO/1,000	43,000	42,000	40,000
LIMA/2,000	51,000	50,000	47,000
MIKE/5,000	62,000	61,000	58,000

NOTES: 1. These radii apply to all HOB. See FM 101-31-1, app III, annex F.

2. A buffer distance has been added to these radii of safety.

Figure 11.7c.

CHAPTER 12

ATOMIC DEMOLITION MUNITIONS

12.1. GENERAL

a. Orientation:

(1) This chapter contains necessary effects data for the normal tactical use of atomic demolition munitions (ADM) on the surface or in shallow underground emplacements. When time is available for deliverate planning of major demolitions with the larger yield munitions, the engineer element determines the desirability of special deep underground emplacements (e.g., in tunnels) and/or the effects that can be expected against target elements not included in this chapter.

(2) Materiel damage is the primary objective for ADM's. For this reason, the categories of materiel targets have been increased substantially in this chapter compared to the categories for other weapons. Variations in structural qualities and standards for targets such as buildings, underground structures, bridges, and equipment preclude a precise prediction of effects radii. Although in this chapter, the ADM effects radii are taken to be valid within ± 25 percent, variations in structural qualities may increase this uncertainty to ± 50 percent.

b. Employment capabilities.

(1) Yield. ADM's are available with yields of Alfa/0.5 KT, Bravo/1 KT, Delta/5 KT, Echo/10 KT, Golf/50 KT, and Hotel/100 KT.

(2) Fuzing. ADM's can be detonated on the surface, in underground or in underwater emplacements using a time fuze. The time can be varied in 10-minute increments from 10 minutes to 1 hour and in 30-minute increments to 12 hours.

(3) Preinitiation. See figure 13.7 for the necessary considerations when a multiple weapon attack is desired.

c. Employment capabilities.

(1) Tactical system accuracy. There is assumed to be no delivery error for ADM's, permitting a simpler tabulation of weapon effects.

(2) Response time. As a basis for general tactical planning, two hours should be considered the time for a reasonably well-trained crew, operating in daylight under favorable conditions, to prepare and emplace a munition on the surface or a previously prepared emplacement. Night operations, enemy interference, or severe weather conditions may extend this time. This time does not include travel time. For detailed tactical planning, the time required for emplacement should be obtained from the engineer unit concerned.

(3) Special considerations. The target analyst needs no special information for target analysis. The fire mission to the unit includes the GZ and any special emplacement instructions.

d. Fallout. Fallout is an important consideration in the employment of any ADM. With the larger munitions, it may be a major consideration. While radioactive contamination of the crater area increases the effectiveness of ADM's no data are included for induced radiation since it will be greatly overshadowed by fallout.

ADM[1]

[1]Atomic Demolition Munitions.

SEVERE DAMAGE RADII—METERS

Materiel classification	Yield–KT					
	ALFA/.5	BRAVO/1	DELTA/5	ECHO/10	GOLF/50	HOTEL/100
Tunnels and mines Heavy masonry or concrete dams and bridges	50	50	125	175	225	300
Tanks and artillery Locomotives Supply depots Engineer earthmoving equip Field fortifications	75	100	175	250	450	600
Engineer truck-mounted equip Earth-covered surface shelters Blast-resistant reinforced concrete bldgs	100	100	200	250	400	525
Military vehicles Railroad cars Communications equip Truss and floating bridges Monumental-type multistory wall-bearing bldgs Heavy steel frame industrial bldgs Multistory, reinforced concrete frame bldgs	150	200	375	500	950	1,250
Oil storage tanks Multistory, reinforced concrete bldgs (small window area) Multistory, steel frame office bldgs Light steel frame industrial bldgs	250	300	475	650	1,125	1,425
Multistory, wall-bearing bldgs (apt house type) Parked combat aircraft	375	450	800	1,000	1,700	2,125
Wood frame bldgs	375	650	1,050	1,325	2,275	2,875

Figure 12.1.

MODERATE DAMAGE RADII—METERS

Materiel classification	Yield–KT					
	ALFA/.5	BRAVO/1	DELTA/5	ECHO/10	COLF/50	HOTEL/100
Tanks and artillery Field fortifications	100	125	225	300	550	750
Earthmoving and truck-mounted engr equip Locomotives Military vehicles Earth covered surface shelters	125	175	325	450	850	1,100
Railroad cars Blast resistant reinforced concrete bldgs Truss and floating bridges	175	200	375	500	1,000	1,300
Heavy steel frame industrial bldgs Multistory, reinforced concrete frame bldgs Monumental-type multistory wall-bearing bldgs Multistory, steel frame office bldgs Light steel frame industrial bldgs	250	350	625	800	1,475	1,750
Multistory, reinforced concrete bldgs (small window area) Oil storage tanks Parked combat aircraft	475	600	1,000	1,275	2,175	2,750
Multistory, wall-bearing bldgs (apt house-type)	525	650	1,125	1,450	2,325	3,100
Wood frame bldgs	850	1,000	1,675	2,125	3,700	4,650

Figure 12.2.

CRATER DIMENSIONS (See note.)

Yield KT	Approx crater dimensions for various soil types–meters							
	Soft rock (dry soil or soft rock)		Hard rock (granite and sandstone)		Saturated soil (water slowly fills crater)		Saturated soil (water rapidly fills crater)	
	Radius	Depth	Radius	Depth	Radius	Depth	Radius	Depth
ALFA/.5	16	6	13	5	24	8	31	4
BRAVO/1	20	7	16	6	30	10	39	5
DELTA/5	34	10	27	8	50	15	67	7
ECHO/10	42	12	34	10	63	18	84	8
GOLF/50	72	17	58	14	108	26	144	12
HOTEL/100	91	21	73	17	136	31	182	15

NOTE: Based on contact surface burst, for more detailed analysis, see engineer element.

Figure 12.3.

CRATER DIMENSIONS SUBSURFACE BURSTS (see note)

Yield KT	Approximate crater dimensions for dry soil or soft rock		
	Depth of Burial	Crater Radius	Crater Depth
Alfa/.5	47	46	16
Bravo/1	58	57	19
Delta/5	93	91	31
Echo/10	114	112	38
Golf/50	183	180	61
Hotel/100	225	221	75

NOTE: At the depths of burial indicated, fallout is reduced to one hundredth of that from a contact surface burst.

Figure 12.4

CASUALTY RADII—METERS

Yield KT	Exposed Personnel		Protected Personnel	
	Prompt	Delayed	Prompt	Delayed
ALFA/.5	425	675	500	500
BRAVO/1	575	775	400	600
DELTA/5	800	1,050	625	625
ECHO/10	900	1,175	700	925
GOLF/50	1,300	1,475	925	1,175
HOTEL/100	1,725	1,725	1,075	1,300

Figure 12.5

FIRE AREAS (See note.)

Yield KT	Expected radii for ignition of wildland fuels during fire season–meters							
	Dry climate (25 percent relative humidity)				Damp climate (75 percent relative humidity)			
	Class I	Class II	Class III	Class IV	Class I	Class II	Class III	Class IV
ALFA/.5	500	500	400	400	500	500	400	400
BRAVO/1	700	600	500	500	600	600	500	400
DELTA/5	1,200	1,100	1,000	800	1,100	1,100	900	700
ECHO/10	1,500	1,400	1,300	1,100	1,400	1,400	1,200	900
GOLF/50	2,800	2,600	2,300	2,000	2,600	2,600	2,200	1,600
HOTEL/100	3,500	3,200	3,000	2,500	3,200	3,200	2,800	2,100

NOTE: For description of fuel classes, see FM 101-31-1, app III, annex F.

Figure 12.6

TREE BLOWDOWN (See note.)

All distances in meters

Yield KT	OBSTACLES TO MOVEMENT							CASUALTIES TO EXPOSED PERSONNEL		
	Foot and wheeled vehicle movement				Tracked vehicle movement					
	Type I	Type II	Type III	Type IV	Type I	Types II, IVa(d)	Types III, IVa(f)	Type I	Types II, IVa(d)	Types III, IVa(f)
ALFA/.5	150	200	200	350	150	200	200	150	200	200
BRAVO/1	200	300	300	500	200	300	300	200	300	300
DELTA/5	400	600	600	1,000	400	600	600	400	600	600
ECHO/10	600	800	900	1,350	600	800	900	600	800	900
GOLF/50	1,200	1,550	1,700	2,650	1,200	1,550	1,700	1,200	1,550	1,700
HOTEL/100	1,700	2,000	2,250	3,400	1,700	2,000	2,250	1,700	2,000	2,250

NOTE: These radii apply to contact aurface burata. For general deacription of foreat stand typea and criteria, see FM 101-31-1, app III, annex F.

Figure 12.7

LIGHT AIRCRAFT IN FLIGHT (See note 1.)

Yield KT	AIRCRAFT SAFETY RADII–meters (See note 2)		
	Light fixed wing	Recon and obsn hel	Transport and util hel
ALFA/.5	4,000	4,000	4,000
BRAVO/1	5,000	5,000	5,000
DELTA/5	9,000	9,000	7,000
ECHO/10	10,000	10,000	9,000
GOLF/50	17,000	16,000	15,000
HOTEL/100	22,000	21,000	18,000

NOTES: 1. Theae radii apply to contact aurface burata. See FM 101-31-1, app III, annex F.
2. A buffer distance has been added to these radii of safety.

Figure 12.8

TROOP SAFETY DISTANCES

In all caaea fallout (1 cloud diameter added to fallout plot) will govern in determination of minimum safe distances. Table below shows distances for INITIAL effecta only

Yield KT	Minimum Distance Required for Troop Vulnerability and Degree of Risk Shown								
	Unwarned Exposed Personnel			Warned Exposed Personnel			Warned Protected Personnel		
	NEG Risk	MOD Risk	EMER Risk	NEG Risk	MOD Risk	EMER Risk	NEG Risk	MOD Risk	EMER Risk
ALFA/.5	1,500	1,300	1,000	1,500	1,300	1,000	1,200	1,000	800
BRAVO/1	1,700	1,400	1,200	1,700	1,400	1,200	1,400	1,200	1,000
DELTA/5	2,100	1,700	1,400	2,100	1,700	1,400	1,700	1,400	1,200
ECHO/10	2,600	1,900	1,600	2,200	1,900	1,600	1,800	1,500	1,300
GOLF/50	4,900	3,800	3,300	3,200	2,300	1,900	2,400	1,800	1,600
HOTEL/100	6,400	5,000	4,400	4,200	2,700	2,200	3,000	2,300	1,700

Figure 12.9

ADM 1

[1]Atomic Demolition Munitions.

TRANSMISSION FACTORS FOR NUCLEAR RADIATION

1. The total dose of radiation received from a particular burst depends upon the amount of protection afforded the target by the surrounding material. The transmission factor (TF) is a measure of the amount of radiation passing through the materials surrounding the target in relation to the total radiation received by the protective material. Stated in equation form—

a. Transmission factor $= \frac{\text{inside dose of radiation}}{\text{outside dose of radiation}}$

To determine the total dose of radiation to be received by a particular target, the equation is solved for the inside dose by multiplying the transmission factor times the outside dose.

b. Inside dose = transmission factor times outside dose.

This general equation applies to either initial radiation or residual radiation. The value of the transmission factor varies with the material and type of radiation. Figure 13.6 shows the transmission factors for various types of protection for both initial radiation and residual radiation.

2. The following illustrative example explains the application of the transmission factors for initial nuclear radiation:

a. Problem. A nuclear weapon is planned for employment on a target consisting of personnel in foxholes. At a distance of 1,300 meters from desired ground zero, the outside dose of radiation is predicted to be 4,000 rad of which 2,500 rad can be attributed to initial gamma radiation and the remaining 1,500 rad to initial neutron radiation. Determine the total dose of radiation received by personnel in foxholes 1,300 meters from the desired ground zero.

b. Solution.

(1) Obtain the TF's from figure 13.6 for personnel in foxholes, initial radiation.

(*a*) For gamma, transmission factor = 0.2.

(*b*) For neutron, transmission factor = 0.3.

(2) The total dose of radiation is obtained by applying equation 1*b* for each type of radiation in turn.

(*a*) Gamma radiation dose = 0.2 × 2,500 rad = 500 rad.

(*b*) Neutron radiation dose = 0.3 × 1,500 rad = 450 rad.

(*c*) Total radiation dose = 500 rad + 450 rad = 950 rad.

3. The following illustrative example explains the application of the TF's for residual radiation.

a. Problem. In crossing an area contaminated by fallout radiation, it is estimated that an individual unprotected in the open would receive 300 rad total dose. The average outside dose rate is 100 rad/hr at H + 1. Assuming that armored carriers are available and that the time in the area remains unchanged, what total dose of radiation is received inside of the carrier and what average dose rate exists inside the carrier?

b. Solution.

(1) Obtain the transmission factor from figure 13.6 for armored carriers, residual radiation. TF = 0.6.

(2) The total dose of radiation is obtained by applying equation 1*b*. Total dose = 0.6 × 300 rad = 180 rad.

(3) The dose rate of radiation inside of the armored carrier can be obtained in the same manner since equation 1*b* applies equally to dose rates. Dose rate = 0.6 × 100 rad/hr = 60 rad/hr.

Protection	Initial		Residual
	Neutrons	Gamma	
Armored carrier	0.7	0.7	0.6
Built-up city area (in open)	1.0	0.5	0.7*
Foxholes	0.3	0.2	0.1
Frame house			
First floor	1.0	0.9	0.5
Basement	0.5	0.3	0.1
Multistory buildings			
Top floor	1.0	0.9	0.1
Intermediate floors	0.9	0.9	.02
Lower floor	0.9	0.5	0.1
Basement	0.5	0.3	.01
Shelter, closed (3 ft earth cover)	0.05	0.02	0.005
Tanks			
Light	0.3	0.2	0.2
Medium	0.3	0.1	0.1
Trucks			
1/4-ton	1.0	1.0	0.8
3/4-ton	1.0	1.0	0.7
$2\frac{1}{2}$-ton	1.0	1.0	0.6
4-7 ton	1.0	1.0	0.5
Woods	1.0	1.0	0.8*

Figure 13.6. Transmission factors for nuclear radiation.

*Note: These transmission factors do not apply to ground survey doses.

Minimum separation between bursts in meters	Minimum delay in minutes
Less than 1,000	3
1,000	2
2,500	1.5
5,000	1
7,500	0.5
10,000	0

Figure 13.7a. Minimum waiting time between bursts.

NOTE: Use only for weapons found in FM 101-31-3. DO NOT USE with FM 101-31-2.

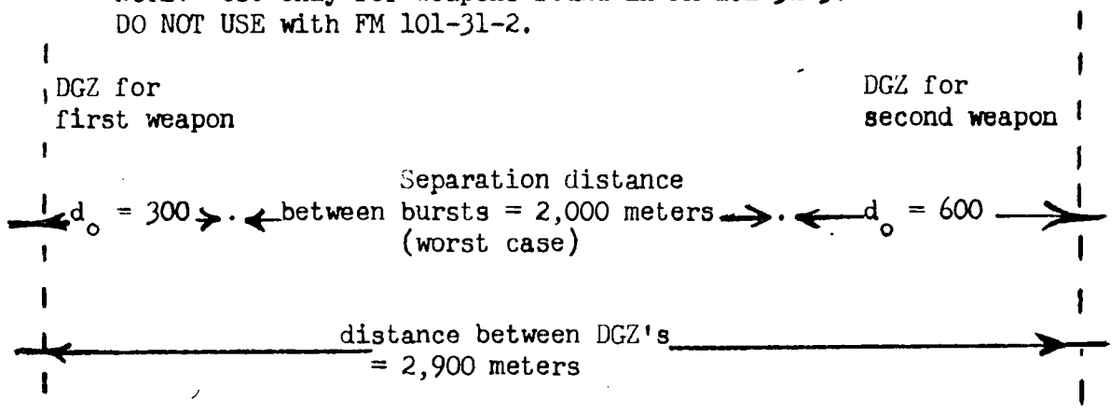

Figure 13.7b. Separation of bursts.

The following problem demonstrates the use of figure 13.7a:

a. Given: (1) Two weapons are to be employed. Their DGZ's are 2,900 meters apart.

(2) d_o for the first weapon is 300 meters.

(3) d_o for the second weapon is 600 meters.

b. Find: Minimum time between bursts.

c. Answer: 2 minutes.

d. Solution: (1) Reference to figure 13.7a indicates that for bursts between 2,500 meters and 5,000 meters apart, a 1.5 minute time delay is required. However, the first weapon may burst right of its DGZ, or the second weapon may burst left of its DGZ. In order to reduce the probability of preinitiation, the time-space separation requirement must consider this circumstance.

(2) As shown in figure 13.7b, the first round may land 300 meters (d_o) right of DGZ. The second round may land 600 meters (d_o) left of its DGZ. From these facts, it can be seen that the weapons could land as close together as 2,000 meters (2,900-(300 + 600)).

(3) Entering figure 13.7a, it can be seen that for a separation distance of less than 2,500 meters, a delay of 2 minutes is required.

Yield (KT)	Personnel			Materiel (See note)	
	Exposed		Protected (tanks or foxholes)	Military wheeled vehicles (moderate damage)	Tanks and artillery (moderate damage)
	No thermal protection	With thermal shielding			
ALFA/.5	950	950	750	200	125
BRAVO/1	1,200	1,200	950	250	150
CHARLIE/2	1,300	1,300	950	325	200
DELTA/5	2,000	1,375	1,100	500	300
ECHO/10	2,950	1,525	1,200	650	400
FOXTROT/20	3,500	1,825	1,325	875	525
GOLF/50	5,800	3,375	1,500	1,250	750
HOTEL/100	7,700	3,625	1,650	1,650	975
INDIA/200	10,475	5,025	2,350	2,175	1,300
JULIETT/500	15,600	7,400	3,175	3,150	1,850
KILO/1,000	20,900	10,000	4,025	4,150	2,450
LIMA/2,000	27,400	13,500	5,075	5,475	3,250
MIKE/5,000	38,400	20,000	6,900	7,900	4,675

NOTE: For other materiel targets with response similar to wheeled vehicles or tanks and artillery, see figure IV.3.

Figure 13.8 Vulnerability radii (R_V) for analysis of own vulnerability.

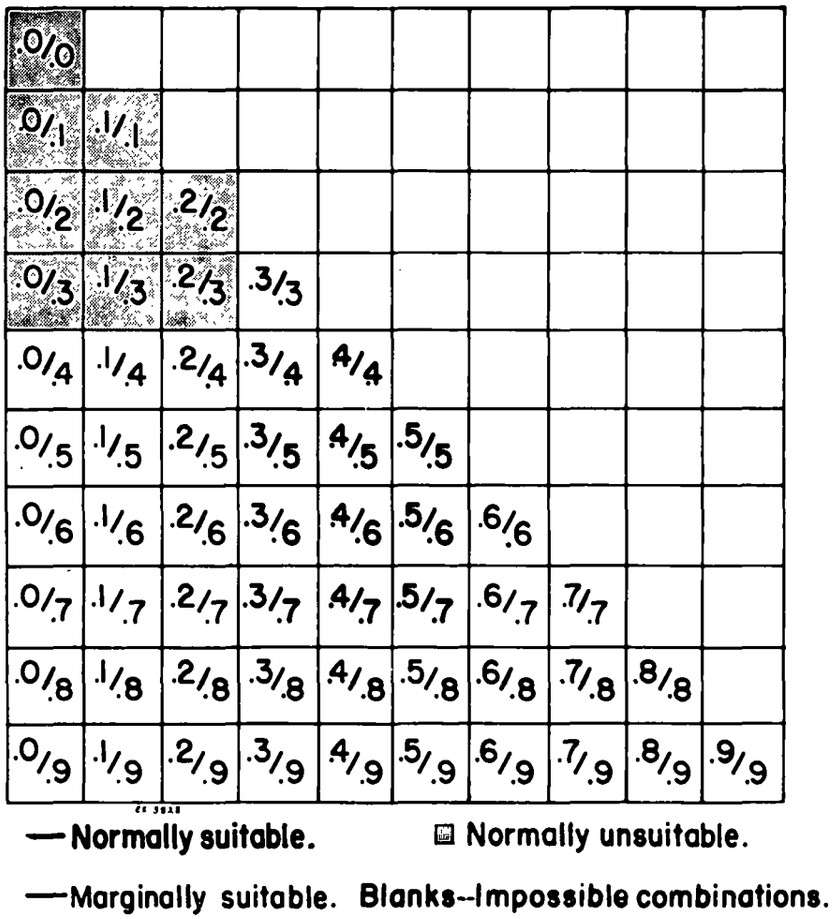

Figure 13.9 Combined coverage indexes. (Color codes shown are for destruction.)

Exposed personnel	Protected personnel	Wheeled military vehicles	Tanks and artillery
Primary: Personnel in the open. Thermal effects not considered.	Primary: Personnel in foxholes.	Primary: Moderate damage to wheeled vehicles.	Primary: Moderate damage to tanks and other track mounted combat vehicles and artillery.
	Secondary: Personnel in basements. Personnel in armored vehicles for yields less than 200 KT.	Secondary: Moderate damage to railroad cars, LVT's and DUKW's on land, truck mounted engineer equipment and missile and rocket launchers. Severe damage to radios, fire-control equipment and concertina entanglements.	Secondary: Personnel in armored vehicles for yields of 200 KT or greater. Moderate damage to infantry weapons, track mounted engineer equipment and railroad locomotives. Severe damage to supply dumps, telephones, switchboards, double apron barbed wire, and highway, railroad and float bridges.

Figure 13.10. Target vulnerability categories.

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:
J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:
Active Army:

CofSA (2)
VCofSA (2)
DCSPER (5)
ACSI (5)
DCSOPS (12)
DCSLOG (5)
Ofc Res Comp (2)
SGS (5)
COA (2)
CARROTC (2)
CINFO (1)
CNGB (2)
CRD (2)
CLL (1)
TIG (1)
TAG (2)
TJAG (1)
CMH (2)
CofCh (2)
USASA (2)
CofEngrs (5)
TSG (5)
CSigO (5)
CofT (1)
USA CD Agcy (2)
USCONARC (20)
USA Mat Comd (5)
ARADCOM (5)
ARADCOM Rgn (5)
OS Maj Comd (5)
OS Base Comd (5)
LOGCOMD (5)
MDW (2)
Armies (10)
Corps (10)
Div (10)
CO (5)
Bde (5)
Regt/Gp/Bg (5)
Bn (2)
USMA (2)
USAWC (5)
Joint Sch (2)
MFSS (2)
USA Ord Sch (10)
USACAS (1)
USWACS (34)
USAAVNS (1)
USAOGMS (36)
Hosp (1)
POE (5)
Engr Dist (5)
Div Engr (5)
Army Dep (1)
PG (2)
Arsenals (1) except Picatinny (2)
USA Corps (5)
MAAG (2)
Mil Msn (2)

NG: State AG (3).
USAR: Div (2).
For explanation of abbreviations used, see AR 320-50.

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